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Remarks

Thorough examination by the Examiner is noted and appreciated.

The claims have been amended to clarify Applicants disclosed invention. No new matter has been added.

For example, support for the claim amendments are found in the original claims and in the Specification at:

At Paragraph 0038:

"The present invention contemplates a novel method suitable for cleaning the interior surfaces of a process chamber such as a chemical vapor deposition (CVD) chamber. The method includes **reacting nitrous oxide (N₂O) with nitrogen trifluoride (NF₃)** in a plasma to generate nitric oxide (NO) and fluoride (F) radicals in the process chamber. The increased density of nitric oxide radicals generated from the nitrous oxide and nitrogen trifluoride enhances and expedites the etch and removal rate of the residues on the interior surfaces of the chamber.

This substantially reduces the quantity of the relatively-expensive nitrogen trifluoride which is necessary to efficiently and expeditiously carry out the chamber cleaning process."

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At Paragraphs 0047 and 0048:

"According to the method of the present invention, the silicon nitride and silicon dioxide residues 103 are removed from the interior surfaces 101 of the process chamber 100 using a nitrous oxide/nitrogen trifluoride mixture 10. The nitrous oxide/nitrogen trifluoride mixture 10 forms a plasma 12 inside the process chamber 100. In the plasma 12, the nitrous oxide reacts with the nitrogen trifluoride to form nitric oxide radicals, fluoride radicals and molecular nitrogen, according to the following formula:



"The highly-reactive nitric oxide radicals and fluoride radicals react with and remove the silicon nitride and silicon dioxide residues 103 from the interior surfaces 101. After the cleaning process, the resulting nitrogen- and fluoride-based gases are evacuated from the process chamber 100 typically using the vacuum pump 102."

At Paragraph 0049:

"Figure 2 illustrates a flow diagram of sequential process steps carried out according to a method of the present invention. In process step S1, nitrous oxide gas (N_2O) is mixed with nitrogen trifluoride (NF_3) gas. The nitrous oxide gas and nitrogen trifluoride gas are typically also mixed with an inert carrier gas such as argon (Ar) or helium (He). Preferably, argon is the carrier gas since

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argon facilitates a more efficient cleaning process as compared to helium."

PREMATURE FINALITY

Applicants respectfully request Examiner to WITHDRAW THE FINALITY OF THE ACTION. Applicants' note that Examiner has made final the most recent office action on new grounds relying on prior art not of record, Nguyen et al. and San et al. Applicant's previous amendments added limitation relating to the temperature of the process and the power used, clearly disclosed elements that should have reasonably been expected by Examiner to be claimed by Applicants.

Applicants reproduce relevant portions of the MPEP concerning FINALITY OF OFFICE ACTIONS:

706.07 Final Rejection

Before final rejection is in order a clear issue should be developed between the examiner and applicant. To bring the prosecution to as speedy conclusion as possible and at the same time to deal justly by both the applicant and the public, the invention as disclosed and claimed should be thoroughly searched in the first action and the references fully applied; and in **reply to this action the applicant should amend with a view to avoiding all the grounds of rejection and objection.**

The applicant who is seeking to define his or her invention in claims that will give him or her the patent protection to which he or she is justly entitled

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should receive the cooperation of the examiner to that end, and not be prematurely cut off in the prosecution of his or her application.

706.07(a) Final Rejection, When Proper on Second Action

Under present practice, second or any subsequent actions on the merits shall be final, except where the examiner introduces a new ground of rejection that is neither necessitated by applicant's amendment of the claims nor based on information submitted in an information disclosure statement filed during the period set forth in 37 CFR 1.97(c) with the fee set forth in 37 CFR 1.17(p). Where information is submitted A second or any subsequent action on the merits in any application or patent involved in reexamination proceedings **should not be made final if it includes a rejection, on prior art not of record, of any claim amended to include limitations which should reasonably have been expected to be claimed.** See MPEP § 904 *et seq.* For example, one would reasonably expect that a rejection under 35 U.S.C. 112 for the reason of incompleteness would be replied to by an amendment supplying the omitted element.

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Applicants therefore, respectfully request Examiner withdraw

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the Finality of the most recent action to allow entry of the present amendments to give Applicants an ample opportunity to distinguish their invention over the newly cited art, as they are entitled to do.

Claim Rejections

1. Claims 1, 3, 9, 13, 15, and 17 stand rejected under 35 USC 102 (e) as being anticipated by Nguyen et al. (US 6,569,257).

Nguyen et al. disclose a method for cleaning silicon carbide and/or organo silicate deposits from a process chamber using a hydrogen/fluorine base plasma (see Abstract; see col 5, lines 44 - col 6, line 33).

Nguyen et al. nowhere disclose Applicants method including:

"providing a gas mixture comprising nitrous oxide and nitrogen trifluoride without the addition of hydrogen and nitrogen gas wherein said nitrous oxide:nitrogen trifluoride volume ratio is at least about 0.2;"

or

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"providing a gas mixture consisting essentially of nitrous oxide, nitrogen trifluoride, and optionally an inert carrier gas wherein said nitrous oxide:nitrogen trifluoride volume ratio is at least about 0.2;"

Nguyen et al. is clearly insufficient to anticipate Applicants disclosed and claimed invention.

"A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987).

"The identical invention must be shown in as complete detail as is contained in the ... claim." *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226, 1236, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989).

2. Claims 2, 4-8, 10-12, 14, 16, and 18-20 stand rejected under 35 USC 103(a) as being unpatentable over Nguyen et al., above, in view of San et al. (US 6, 767, 836).

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Applicants reiterate the comments made above with respect to Nguyen et al.

San et al. discloses an in-situ oxygen plasma cleaning process, a downstream oxygen plasma cleaning process and a downstream oxygen-fluorine plasma cleaning process (see Abstract; col 2, lines 54-67). San et al. also disclose a nitrogen trifluoride/inert gas cleaning process before or after the oxygen plasma cleaning process (see e.g., Figures 1A, 1B, 1C; col 6, lines 35 to col 7, line 20).

San et al. also disclose an embodiment where the reactor is cleaned by a downstream (generated in a separate chamber) oxygen-fluorine plasma cleaning process (col 7, lines 21-32) where the oxygen-fluorine plasma is used in a pre-cleaning process or a post deposition cleaning process.

San et al. **teach away** from generating active fluorine species inside the chamber to avoid undesirable variations in a subsequent CVD deposition process (col 2, lines 32-37).

San et al. disclose that in the oxygen plasma cleaning process that the oxygen containing gas may be mixed with **inert gas or nitrogen** to stabilize the plasma (col 4, lines 17-22).

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Nowhere do San et al. disclose or teach a NF₃/N₂O gas cleaning mixture as Applicants claim including introducing said gas mixture (without hydrogen and nitrogen) into the chamber for cleaning.

Modifying Nguyen et al. with the teachings of San et al., who **teach away** from generating active fluorine within the deposition chamber, would render the method of San et al. unsuitable for its intended operation.

Even assuming *arguendo*, a proper motivation for combining the teachings of San et al., who nowhere disclose the use of hydrogen or the effect thereof and teach away from generating active fluorine within the deposition chamber, and Nguyen et al., who disclose cleaning a chamber with a hydrogen/fluorine based plasma, such combination fails to produce Applicants disclosed and claimed invention.

Thus, the combination of Nguyen et al. and San et al. is insufficient to make out a *prima facie* case of obviousness.

"Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination^o and the reasonable

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expectation of success must both be found in the prior art, and not based on applicant's disclosure." *In re Vaack*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

"A prior art reference must be considered in its entirety, i.e., as a whole including portions that would lead away from the claimed invention." *W.L. Gore & Associates, Inc., Garlock, Inc.*, 721 F.2d, 1540, 220 USPQ 303 (Fed Cir. 1983), cert denied, 469 U.S. 851 (1984).

"If proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification." *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984).

3. Claims 1-4, 9, 10, and 13-18 stand rejected under 35 USC 102(b) as being anticipated by Pang et al. (USPUB 2001/0016674).

Pang et al. disclose an experimental process carried for determining the composition of particles (residue) exiting an exhaust (foreline) system to determine the operability of a prototype DPA (downstream plasma cleaning apparatus) (see Abstract; paragraph 0037; paragraph 0081). Pang et al. disclose an **NF3/N20/N2** cleaning plasma with a ratio of 5:2:10 (paragraph 0084). Pang et al. teach

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that **N2 (nitrogen gas)** is an active species in producing the residual particles in the foreline (see paragraph 0033), and therefore a critical component in their experiment.

Nowhere do Pang et al. disclose or suggest Applicants disclosed and claimed invention of:

"providing a gas mixture comprising nitrous oxide and nitrogen trifluoride without the addition of hydrogen and nitrogen gas wherein said nitrous oxide:nitrogen trifluoride volume ratio is at least about 0.2;"

or

"providing a gas mixture consisting essentially of nitrous oxide, nitrogen trifluoride, and optionally an inert carrier gas wherein said nitrous oxide:nitrogen trifluoride volume ratio is at least about 0.2;"

In addition, nowhere do Pang et al. teach "maintaining a temperature of from about 65°C to about 300°C in said process chamber;"

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Pang et al. is insufficient to make out a prima facie case of anticipation with respect to Applicants disclosed and claimed invention.

4. Claims 5-8, 11, 12, 19, and 20 stand rejected under 35 USC 103(a) as being unpatentable over Pang et al., above, in view of Shang et al. (US 5,788,778).

Applicants reiterate the comments made above with respect to

Pang et al. Applicants further note that any argument invoking result effective variable is inapplicable where the general conditions of the claims have not been shown.

Moreover nowhere do Pang et al. recognize or suggest a solution to the problem that Applicants have recognized and solved by their disclosed and claimed invention:

"A method of cleaning a process chamber to reduce an amount of nitrogen trifluoride to remove silicon nitride and silicon oxide deposits"

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On the other hand, the fact that Shang et al. teaches that nitrogen, argon, helium, hydrogen, or oxygen may be used as a carrier gas in carrying a remotely (activated) generated plasma in an upstream chamber downstream to a reactor chamber for cleaning the reactor (see Abstract; col 2, lines 34-56) does not further help Examiner in establishing a *prima facie* case of obviousness.

Thus, even assuming *arguendo*, a proper motivation for combining the different principle of operation contained in the teachings of Pang et al. DPA (who teach generating particles for evaluating a downstream plasma cleaning apparatus where nitrogen is an active species) with the teachings of Shang et al. (who teach remotely generating a plasma upstream from the chamber to be cleaned and then using a carrier gas to carry the active species to the chamber for cleaning), such combination does not produce Applicants disclosed and claimed invention.

Thus the combination of Pang et al. and Shang et al. is insufficient to make out a *prima facie* case of obviousness with respect to Applicants disclosed and claimed invention.

"Finally, the prior art reference (or references when combined) **must teach or suggest all the claim limitations.** The teaching or

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suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure." *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

"If the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious." *In re Ratti*, 270 F.2d 810, 123, USPQ 349 (CCPA 1959).

"The prior art must provide a motivation or reason for the worker in the art, without the benefit of appellant's specification, to make the necessary changes in the reference device." *Ex parte Chicago Rawhide Mfg. Co.*, 223 USPQ 351, 353 (Bd. Pat. App. & Inter. 1984).

The Claims have been amended to clarify Applicants disclosed and claimed invention and distinguish over the applied art. A favorable consideration of Applicants' claims is respectfully requested.

Based on the foregoing, Applicants respectfully submit that the

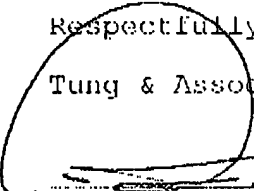
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Claims are now in condition for allowance. Such favorable action by the Examiner at an early date is respectfully solicited.

In the event that the present invention as claimed is not in condition for allowance for any reason, the Examiner is respectfully invited to call the Applicants' representative at his Bloomfield Hills, Michigan office at (248) 540-4040 such that necessary action may be taken to place the application in a condition for allowance.

Respectfully submitted,

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